BREEDERS' ASSOCIATION WILL CHANGE ITS NAME

As soon as certain necessary legal formalities can be fulfilled, the American Breeders' Association will become the American Genetic Association. The AMERICAN BREEDERS' MAGAZINE will, with the present number, end its fourth volume, and begin next month in a larger size under the name of THE JOURNAL OF HEREDITY. Its character and scope will, of course, remain the same as at present, except as improved by a steady effort to raise the standards as rapidly as the resources of the association allow.

While the name of the association and magazine were correct at the time of their foundation, it has been felt by a large section of the membership for several years past that the word "Breeders" no longer accurately described to the general public the purpose of the association, since in the public mind it was connected solely with live stock. The steady growth of eugenics, and the full recognition granted to this new and important science by the association, have further made a change of name desirable. At a meeting of the council held in the University Club, Washington, D. C., on November 15, it was voted to make the change without delay, as above outlined.

The council considered with much deliberation the present status of eugenics in the United States. There is a general recognition among members of this association that the need is urgent at the present time for active and scientific leadership of the rapidly growing eugenics movement, lest it be detached from its proper base of genetics and be captured by sentimentalists and propagandists with slight knowledge of its biological foundation. The council accordingly arranged for the creation of Committees on Education and Extension, whose function it will be to endeavor to guide public sentiment along strictly scientific lines, in a more active way than is possible to our present Committees on Research. The personnel of the new committee or committees will probably be announced in the next issue of the magazine.

Arrangements were completed for the publication of the magazine (under the name of THE JOURNAL OF HEREDITY) regularly each month from now on. Its size will be seven by ten inches.

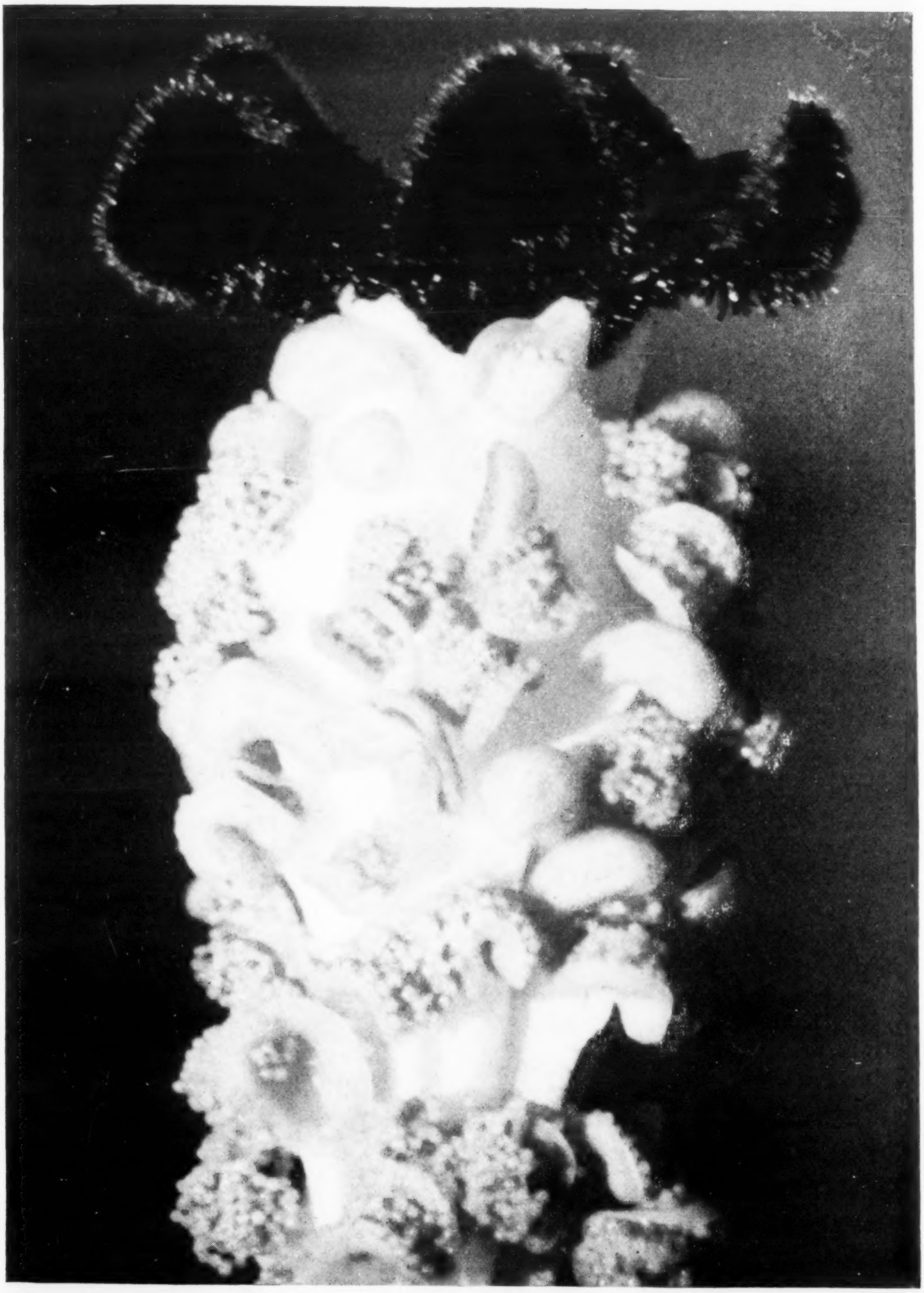
For many reasons the council decided not to hold any single general meeting of the association in 1914, but to hold, instead, meetings of the three research committees, at the call of the chairmen of the respective committees after consultation with their associates. These meetings will bring together the men actively engaged in each line of work, and will, it is hoped, offer the opportunity for the achievement of some serious scientific results. The magazine will be the vehicle for coördination of the three sections.

It was voted to hold a general meeting in 1915, in connection with the Panama-Pacific International Exposition at San Francisco. Dr. H. J. Webber and Dr. E. B. Babcock, both of the University of California, were named as a local committee in charge of arrangements. The exact date will be decided later.

In order to give at least a slight compensation to members who publish results of their work in the magazine, the council voted to give to each contributor twenty-five copies of the issue in which his article appears, with the privilege of buying as many more copies as he wishes of that issue at ten cents each, provided an order is placed in advance of publication. In the case of articles of a more technical character, fifty separates will be furnished, instead of the bound magazines, if the author requests it when submitting his contribution. The editor was instructed to insist on full and satisfactory photographic illustration of every article capable of such treatment; unillustrated contributions will be published only in exceptional cases.

The general question of formation of branch associations, and affiliation of local breeding and eugenic societies with this association, was considered and arrangements made whereby such affiliation can be put into effect on terms equitable to both parties.

The Secretary reported a surprisingly keen interest in the association, considering that its activity was entirely suspended throughout the summer. New members are voluntarily coming in daily, attracted principally by the coöperative feature of our work. At present the only hindrance to the fullest possible efficiency of the organization is the carelessness of many members in neglecting to pay their dues promptly.



Photograph by David Fairchild, copyright, 1913, *by the A. B. A.*

REPRODUCTIVE ORGANS OF HIBISCUS.

At the top is the female organ, the stigma, supported on its slender column called the style. Around this style, completely enclosing it, are the many stamens, grown together into a solid tube, over the surface of which are scattered the pollen-containers or anthers. The pollen grains are seen falling from these anthers. (Fig. 1.)

REPRODUCTION IN HIBISCUS

David Fairchild

Every practical breeder of plants is familiar with the appearance of pollen, and knows how it looks when the anthers, or male organs, of the flower split open, exposing the golden yellow pollen grains so that the bees can get them. To the general public, however, who do not carry pocket microscopes, this photograph will perhaps be instructive. It is possibly the first one ever made to show the pollen tumbling from the anthers.

The dark, furry or hairy top of the figure, which looks like a felt hat, is the stigma of the flower, its female reproductive organ, which is supported on a slender column called the style. Around this style, completely enclosing it, are the many stamens, which in this species have grown together into a solid tube, over the surface of which are scattered the kidney-shaped pollen containers or anthers. In the photograph, these anthers have opened lengthwise and the pollen grains are tumbling out. They are golden yellow, and stick together when fresh, but as soon as dry they come off on one's hand with the slightest touch. These pollen grains are covered with minute spines, too small for the camera to bring out.

When one of these grains is carried on to the surface of the stigma by some insect, it sends out a long, slender tube, which grows down through the soft tissue of the pistil, until its tip encounters the embryo sack which is enclosed in the swollen base, or ovary, of the pistil. In this ovary lies the egg cell with its unfertilized nucleus. The moment that pollen tube and embryo sack touch, there forms an opening between the two, and a nucleus slips from the pollen tube tip into the egg cell. This male nucleus gravitates instantly toward the female nucleus, and the two join and together start the activity which divides the first cell and sets in motion the whole marvelous machinery of cell growth, which leads to the seed and, subsequently, to the tree or shrub or whatever the plant may be.

The procedure in practically all flowering plants is essentially similar, and in animals this essential part of the process—that is, this fusion of nuclei—is practically universal.

It is this great borderland of knowledge which attracts the real plant and animal breeder, for he feels convinced that any knowledge of these beginnings of individual life must give tremendous power to the coming generations of human beings.

PUBLICATIONS RECEIVED

DISSIMILAR HEREDITY IN MENTAL DISEASE. A. J. Rosanoff. Reprint from *A. Jour. of Insanity*, LXX, 1, July, 1913. Address delivered before American Breeders' Association, ninth annual meeting, Columbia, S. C., Jan., 1913.

PLANT BREEDING. William E. Praeger. Reprint from 14th annual report Michigan Academy of Sciences. President's address, 1912, pp. 22-32.

A STUDY OF STATISTICAL METHODS WITH BARLEY. W. O. Whitcomb. Reprint from *Jour. Am. Soc. Agron.*, V, 2, pp. 83-101; April–June, 1913.

DIE DURCHFÜHRUNG DER STERILIERUNGSGESETZE IN DEN VEREINIGTEN STAATEN VON NORDAMERIKA. Geza von Hoffmann (Austrian vice-consul in Chicago). Reprint from *Monatsschrift für Kriminalpsyschol. und Strafrechtsreform (Köln)*; year 10, pp. 297-302.

GALVANOTROPIC ORIENTATION IN *Gonium pectorale*. A. R. Moore and T. H. Goodspeed. Reprint from U. of Calif. Pub. in Physiology, IV, 4, pp. 17-23, May 6, 1911.

THE TEMPERATURE COEFFICIENT OF THE DURATION OF LIFE IN BARLEY GRAINS. T. Harper Goodspeed. Reprint from *Bot. Gaz.*, 51-220-224, March, 1911.

ON THE PARTIAL STERILITY OF NICOTIANA HYBRIDS MADE WITH *N. sylvestris* AS A PARENT. Thomas Harper Goodspeed. U. of Calif. Pub. in Botany, V, 4, pp. 189-198, Mar. 21, 1913.

QUANTITATIVE STUDIES OF INHERITANCE OF NICOTIANA HYBRIDS. Thomas Harper Goodspeed. U. of Calif. Pub. in Botany, V, 3, pp. 169, 198, Jan. 9, 1913.

RESEARCH IN EUGENICS

CHARLES B. DAVENPORT

Eugenics is a subject that can be considered from many points of view; but the engenical interests of this Association have always been connected with research in that field. The inquiry is a fair one;—how can research be made in eugenics?

If, in seeking an answer to this question, we turn to plant and animal breeding, we find in these fields methods which have for some time been standardized and are highly successful in yielding results. If it is desired to improve a race, one determines by appropriate matings the method of inheritance of the traits which it is desired to combine in the improved breed, and then one makes such matings and those of second and third or even later generations of the hybrids as shall yield a more or less nearly pure strain—*i. e.*, a strain reproducing in successive generations the desired combination of qualities.

The application of these methods to man has its clear limitations. It is not in accordance with the social ideals of our time that people should be mated as roses and lilies, or canaries and butterflies, are in order to determine how particular traits are inherited. The produce of the mating is so vastly important, the launching upon the cosmos of an immortal soul (we are told) so momentous a thing (not to speak of the birth of a new potential voter and national ruler) that society can not permit of experiments in mating people just to satisfy the curiosity of the man of science. Fortunately, the man of science has no need, for his purposes, of controlling the matings of men. Matings as they are made, with little effective interference or regulation by organized society, afford him all possible combinations; more perhaps than the most ingenious student of genetics could have planned. It remains for the student of eugenics merely to observe the produce of the various matings that have been made. By the study of the characters of the offspring in relation to the characters of the parents, grandparents, uncles, aunts and first cousins, the laws of inheritance of characters can in many cases be worked out. What the student of human heredity needs is accurate, full data concerning the distribution of characters

in a fraternity, in the individuals that stand near of kin on the father's side of the house and in the individuals that stand near of kin on the mother's side of the house.

The methods of getting this data are various. The most satisfactory way, in many respects, is to secure the coöperation of numerous intelligent, sympathetic individuals in recording their family traits through three generations as just specified. If, then, these records are sent to a central bureau for analysis, we may expect the method of inheritance of many characters soon to become known. Incidentally, an intelligent person will find this work of recording his own traits and that of his relatives a matter of great interest to him while he is doing it. Moreover, he may well consider it a duty both to the nation and the rising generation in his own family to secure such data from those who alone can supply it, while they are still alive, and to record it.

To facilitate the task of making this record the Eugenics Record Office has had prepared blank schedules—called "Record of Family Traits"—of which it is ready to mail a copy, without charge, to any person who will write for it and agree eventually to deposit a copy, filled out, with that Office. In the Office are now deposited over one thousand such records, which have been submitted to it in confidence, and which are being used for analytical purposes. When desired, two copies of the schedule are sent, in order that one may be retained by the compiler and preserved among the most treasured family possessions.

If you would like to take a share in this work of eugenic research, write to the Eugenics Record Office, Cold Spring Harbor, Long Island, New York, for one (or two) copies of the "Record of Family Traits."

Constructive Eugenics

It is possible that if some of the philanthropic endeavor now directed toward alleviating the condition of the unfit should be directed to enlarging the opportunity of the fit, greater good would result in the end. In breeding animals and plants the most notable advances have been made by isolating and developing the best, rather than by attempting to raise the standard of mediocrity through the elimination of the worst.—H. E. Walter: "Genetics."

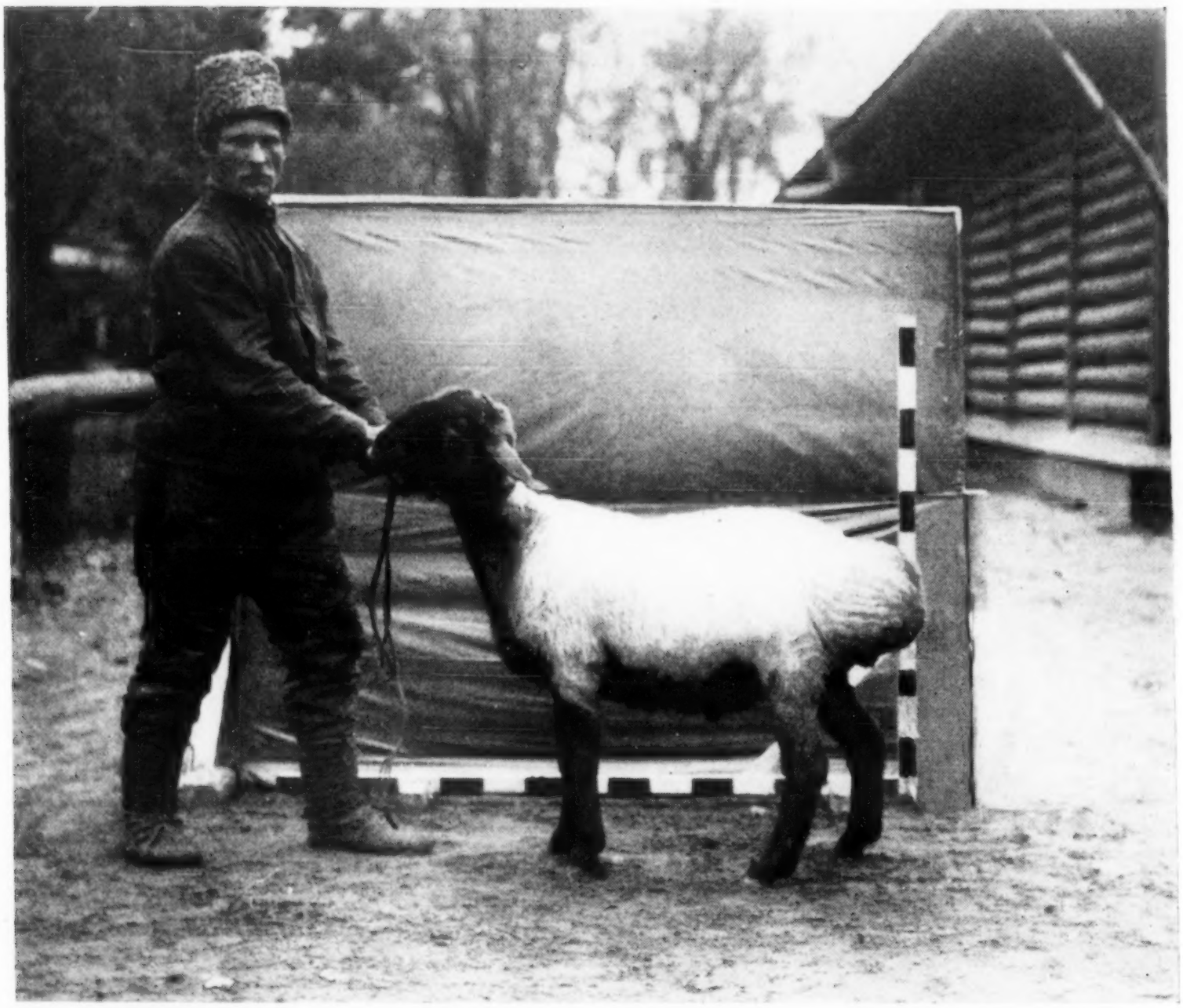
STRANGE SHEEP OF ASIATIC RUSSIA

Broad-Tailed and Fat-Rumped Creatures Among Hardiest Domestic Animals Peculiar Results of Hybridization—First National Sheep Congress at Moscow

DR. C. C. YOUNG, *Belen, Texas*

The sheep of Asiatic Russia, mostly brown or black in color, and hence easily distinguished from the sheep of European Russia—which are always white unless they have become pigmented by the black Danadar or red Kúrdiuk—are noted for their great hardiness and wonderful disgestive abilities. Whether of the fat-rumped (Kurdiuk) type, (*Ovis steatopyga*) or the broad-tailed species (*Ovis platyura*), they are perhaps the hardiest domestic animals known, with the exception of the camel and burro. The introduction of these sheep into the United States for the purpose of fur raising, and to improve the hardiness and mutton of some of our odoriferous shortwools of the Southwest is a task we have assigned to ourselves, and the pursuit of this task found us in Moscow, Russia, at the time of the first national sheep congress there, from the fifth to the fifteenth of October, 1912.

The success of this convention, the outcome of many years' work, is largely due to the intelligence and industry of Count Stcherbatiev, president of the Agricultural Society of the Province of Moscow. He was vigorously assisted by His Excellency A. S. Yermoloff, for twelve years minister of agriculture, and now a senator for life, and member of His Majesty's Council. It is to this gentleman that much credit is due for the success of the importations of Karakúl sheep into the United States in the past. He was chairman of the convention; the vice-chairman was Pavel Petrovich Ganko, one of the most competent authorities on the Karakúl breed. Mr. Pravochinsky, chief of sheep investigations in the department of agriculture, was secretary. Among the judges was Dr. J. V. Sinitzin, the greatest Russian authority on Karakúl; some fourteen years ago he imported the first herd of these sheep to Crimea, and

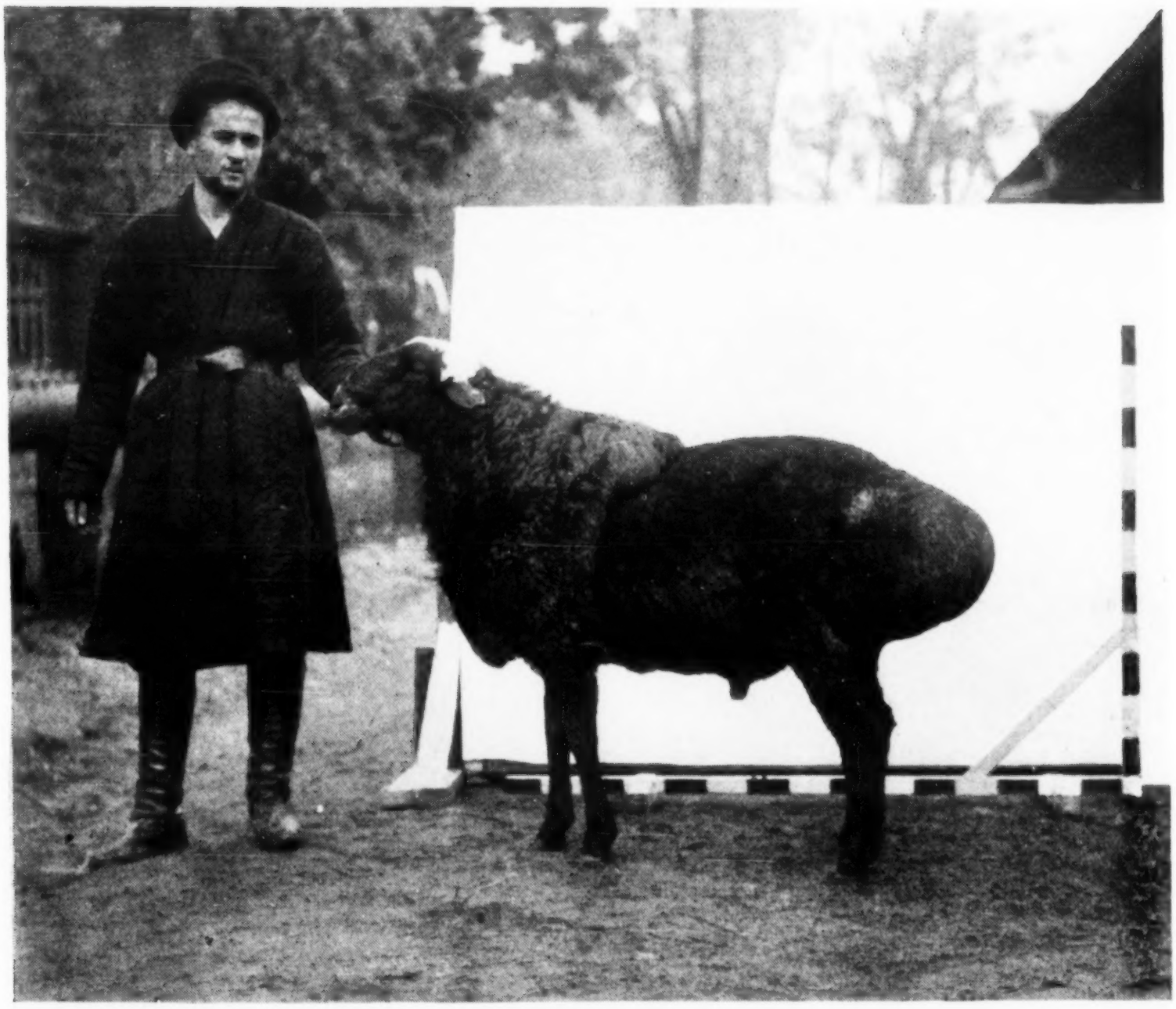


TWO-YEAR OLD CHULMI.

This ram belongs to a class from Bokhara in Turkestan, a region with a very severe desert climate. By natural selection the sheep of this region have become among the hardiest demesticated animals. (Fig. 2.)

for his excellent book, "Malitch and Arabi," received the degree of Magister of Veterinary Sciences. The exhibition was held at the Moscow Agricultural College, situated at the beginning of the beautiful Smolensky boulevard.

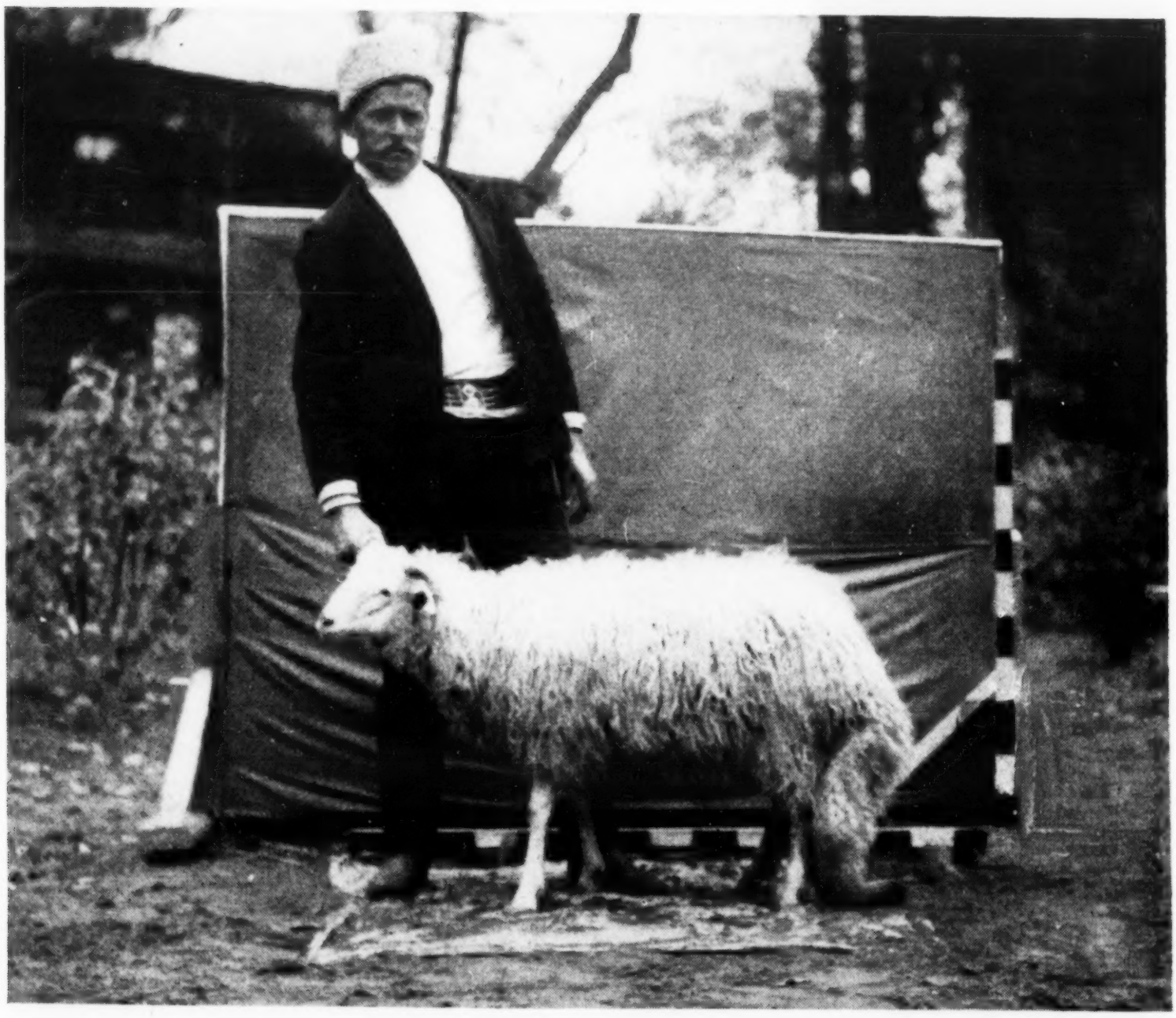
According to Palace and Natusius, the sheep of Europe and Asia are divided into four classes,—namely, longtails, shorttails, fat rumps and broadtails. We are not satisfied with this classification, especially when it comes to the longtails, to which most of the English breeds belong, as do the Merinos, the common Russian longtail, Tcherkes and Sigei; and we do not consider that such grade fur-producing Karakúls as the Sokolievskaja, Reshetilev and Tshushka, belong exactly to this class,—we are inclined to classify them with the broadtails. However, all of these classes were repre-



FAT-RUMP RAM FROM CENTRAL ASIA.

The development of the two huge but symmetrical globules of fat which have covered the buttocks is well shown in this photograph of a black ram of the class Tshuiskœ. The tail is practically atrophied. (Fig. 3.)

sented at the fair. The Northern and Romanovskaja are shorttails indeed worth mentioning. Among the fat rumps, which *per se* are not fur producing, there were a great many breeds, such as the Kalmik, Kirghiz, Mongol, Burat, and numerous "Kurdiuks," from the Caucasus and Bokhara. We were surely convinced that these long-eared sheep, usually red, and bearing tremendous, symmetrical, fat pillows, that hide the short, often atrophied tail, have not the same origin as the Karakúl breeds. We are reminded at this moment of a statement made by Charles Goodnight, of Texas, some three years ago, when he rightly insisted that his red mutton Persian fat-tails from which Col. Jones, of Las Vegas, got his start should not be called by us broadtails.



BROADTAIL VOLOSHSKAJA RAM.

Although only six months old, his tail is dragging on the ground. At maturity, it may weigh as much as forty pounds, and may have to be supported artifically, in order to enable its owner to walk. (Fig. 4.)

The exhibition of a number of breeds coming from the Caucasus (Asia Minor), and resulting from crosses between fat-tails and broadtails, was very interesting indeed. Those most noteworthy were the Erik, Bozach, Mazech, Karabach, Lezgink, Osetin, Avar, Tushin, and Kjara. We were told by a Tartar gentleman, A. Ayrap Kalantar, of Tiflis, that these sheep had the very best of mutton and that they could endure any amount of hardship.

The broadtail class was very well represented. There were Karakúls, Malitches, Pirnajas, Valoshskaja, Karachaev and Tushinskaja. Of these we purchased several, as will be explained later. The Karachaev is said to be even better than the Karakúl when it comes to mutton. We had an occasion to eat Kirghiz and Kalmik "butter," *i. e.*, the fat obtained from the "fat-tailed" sheep,—a name that

should not be used, as the tail of this class of sheep is generally atrophied by the great pressure of the two symmetrical, fat lobules, weighing often thirty pounds; and if present at all, is only about three inches long and not thicker than a finger.

Of the many breeds present the Karakúl, Voloshskaja, Kalmik, Reshetilev, Sokoliev and the Bessarabian Tshushka received the most attention. It was conceded that all of these sheep, except possibly the Kalmik, when crossed with Karakúls, would greatly gain in weight, besides giving excellent skins, which could be utilized for fur purposes. It was especially pointed out that inbreeding must be discontinued and proper selection practiced when it comes to rams intended for breeding. It was unanimously agreed that sheep raising in European Russia could only be advised on a small scale, because the land, being mostly all under cultivation, commands high prices. In the Caucasus, where the large, open steppes made it possible to raise millions of merinos, conditions are rapidly changing. The land is being put into wheat and other small grain. The only Russian steppes that still offer inducements in sheep raising on a large scale are found in Central Asia and Turkestan, where certain nomadic people, as, for instance, the Kalmiks, Kirghiz, Turkmans, Nogaitzi, Sarts, Uzbecks, Tadjveks and other uncivilized Asiatic tribes, are still keeping large flocks; but all of them belong to the coarse-wool varieties, except the pure Afghan fine-wool. The fine-wools, such as the Merinos (having no fur qualities, and in crosses, in fact, ruining the best fur-bearing Karakúl breeds), never did get a start, as it was found that they were not hardy enough to exist in those countries, where a sheep must possess greater "rustling" qualities and be able to go for days without water.

But as every year the Russian Government opens for settlement large tracts of the best of those steppes, some of which are irrigated and others open to dry farming, it is but a matter of a few years when the sheepmen will have to go out of business.

On account of the great increase of late years in the price of grade Karakúl lamb skins, known under the trade-name of Persians and Astrakans, it was decided to ask the government to find ways which would enable the breeders to bring these sheep into European Russia in larger numbers and at less expense. It was pointed out that the peasant would receive almost double the crop from land

KHIRGIZ RAM FROM CENTRAL ASIA.

Sheep of this fat-rump type are usually red, with long pendulous ears and coarse wool. As the lobes of the rump are pure fat, it is cut off and eaten by the natives under the name of "Khirgiz Butter." (Fig. 5.)

on which from time to time sheep have been pastured, and could thereby eliminate the great expense of fertilization. To insure the best breeding rams, the organization recommended the establishing of special breeding stations all over Russia with a view to supplying the peasants with the best and cheapest of rams, the expenses to be borne entirely by the government. Those peasants too poor to buy rams are to have a chance to breed their ewes to these rams free of charge.

When we made our first importation of Karakúl sheep (a term synonymous in Turkestan with the Arabi), we assumed that this breed, when crossed to our longwools, would give us not only fur, greater hardiness and better mutton, but also a much greater weight, and that is the case where the red fat-rump Kurdiuk predominates

in the Karakúl, as is the case with the pronounced type of Dúzbai Karakúls. In one case a Valoshskaja sheep, originating from a cross of fatrump on longtail, weighed nearly twenty pounds more than the heaviest red fatrump at the exhibition. These hybrids show at a glance that they are heavier than our Lincolns, which are the heaviest sheep in America and England. It is indeed strange that the result of the cross above mentioned should have excelled in weight the largest Kalmik fatrump on exhibition; and we bought this specimen, which was owned by Tiu-Men, a Burat chief. The Russians named this Kalmik ram "Verbliud," which means camel, and indeed that name is quite appropriate, judging from his size.

About the difference between "fat-rump" and "broad-tail" sheep, we beg to refer those interested to our article in the September, 1912, issue of THE AMERICAN BREEDERS' MAGAZINE, in which we freely acknowledged our mistake as regards the weight of the Karakúl, stating at the same time that the fat-rump, such as the Kalmik, is the heaviest of all known sheep. That statement is true, if we permit ourselves to forget the statement made above in regard to the Voloshskaja hybrid broadtail. I asked the naturalist Sinitzin if he could assure me that there was not fat-rump blood in this hybrid, and his answer was emphatic that there was not, as he had never found any traces of brown pigment, which is the pigment of the purest types of the fatrumps. But we believe that Sinitzin is mistaken, nevertheless.

The typical fatrump is the largest sheep known, red in color, coarse stiff wool, like our mountain sheep, with the huffs of the extremities so built as to enable it to remove snow and find feed, and, what is most important, the tail consists of only three or four vertebrae, generally atrophied, with two *immense* symmetrical fat lobules covering the buttocks and extending below the knees, weighing from twenty to forty pounds; long pendulous ears, decidedly convex nose and a very large head.

Among our purchases at the fair was, as already stated, a brown, fat-tailed Kalmik buck, but we took him mostly for educational purposes, although the great size of the animal with the immense fat lobules will no doubt appeal to our breeders. Unfortunately, our breeders do not know the difference between a fat-rumped and a broad-tailed sheep (it is not so very long since we found it out ourselves) and often contaminate the red, long-eared Persian fat-

ACHURI EWE FROM BOKHARA.

This black two-year-old is of a type evolved by nature in Central Asia, where such fine wool breeds as the Merino have never even made a start, because they are not hardy enough. Black pigment due to Danadar admixture. (Fig. 6.)

rumps with the gray, broadtail Arabi, and every once in a while I am asked to help market the worthless lamb skins of "Persian" fat-rumps, of which we owned several hundreds, such breeders believing them to be the valuable Persian lamb skins only produced by the Karakúl breeds.

We also bought a four-horned Karachaev from a Turkman chief of Middle Asia, which was represented to us to be a fertile hybrid, resulting from a cross between a grade Arabi and a native wild goat (?). There were several such specimens on exhibit, and we were impressed with the luster of the lamb skins, even though the curls were absolutely open, more so than is the case in the Astrakan type. It is, however, a very wild, dangerous animal, requiring several men to handle it, but it possesses most delicious mutton. In

AN IMITATION OF THE KARAKUL.

Five-year-old ram of the Bessarabian class of Tshushka. Note its close resemblance to the famous Karakúl. It produces a very good fur, and would probably gain largely in weight if crossed with the Karakúl Dúzbai. (Fig. 7.)

its movements it reminds one of the wild white Alaska goat. It is our opinion that the Karachaev is what is left of the black Danadar which found their ways out of central Asia to Asia Minor.

In another article we shall describe our trip through central Asia to get authentic specimens of the Karakúl breed; we shall explain the fatal mistakes of our first importation in 1908, and shall give the data we collected, on which we base our opinion as to the real origin of all the Karakúl breeds.

Need of Education

The eugenic conscience is in need of development, and it is only when this becomes thoroughly aroused in the rank and file of society as well as among the leaders, that a permanent and increasing betterment of mankind can be expected.—H. E. Walter: "Genetics."

BREEDING MEDICINAL PLANTS

Growers Select Most Powerful Drug-Producing Strains and Seek Correlation Between High Potency and External Characteristics

F. A. MILLER

Botanist, Eli Lilly & Co., Indianapolis, Indiana.

Products of medicinal plants are, in their way, as valuable to mankind as those from the cereal, vegetable, fruit, flower, fiber and other economic plants under cultivation. The latter have all yielded to the principles of plant breeding, and have supplied man with a wealth and variety of products which nature's laboratory has never equalled. Why should not medicinal plants yield and produce in a similar manner, and through cultivation and improvement be made to furnish mankind with more efficient remedies against disease?

An examination of the crude vegetable drugs as they occur on the markets of today reveals a mass of inferior materials far in excess of what might be expected. Much of this material is unfit for manufacturing purposes, through adulteration with unknown and worthless admixtures, partial or complete substitution of one plant or plant part for another, or because it is made up of old, inert, mouldy drugs which may have been stored under adverse conditions or collected out of season and improperly cured and packed. All this is due to a lack of power to control the production of crude vegetable drugs. Too much must be left to nature or to none too well informed collectors. The faults and inefficiencies of nature need little comment. A comparison of a few improved varieties with their wild ancestors is sufficient evidence that nature is poorly equipped for the production of improved strains.

Ignorant collectors many times are a menace. Personal experience with many of them has revealed an absence of any sense of responsibility, and but little power of discrimination in selecting and identifying plants. They cannot separate closely related species, a procedure often necessary in the intelligent collection of medicinal plants, and frankly refuse to observe certain rules governing collec-

tion and curing. It is thus evident that the variations of nature, associated with ignorance, often give to the pharmacist and practicing physician a poor or suspected product. Rigid inspections must be enforced at all stages in the process of manufacturing medicinal preparations. But however rigid these inspections may be, they cannot overcome all the variations of plant growth or correct all the mistakes of careless collectors. The supply of medicinal plant products should be controlled with the same degree of nicety as that of agricultural products, or even with greater precision, since in many instances a life is dependent upon the strength and purity of some vegetable drug.

Plant breeders are supplying fruits of varying acid values, corn of high and low percentage of oil and protein, carefully selected sugar beets of high yielding power, and varieties of tobacco suitable for various purposes according to an indicated nicotine content. All of these achievements and numerous others are noteworthy. Of a different character, but of no less importance, are the drug-producing plants which yield the alkaloids, glucosides, saponins, resins, oleoresins, etc., upon which their curative property depends. Cannot the plants yielding these so-called active principles be brought under the influence and control of the breeder, and be made to produce their respective products more abundantly and more consistently than in the wild state? In attempting to answer this question, experiments have been started with several medicinal plants which will extend over a considerable period of time, and involve various problems of selection and breeding.

The Solanaceae offer as rich a field in the development of improved medicinal forms as they have already offered in the production of the potato, tomato, egg plant and capsicum among food-producing plants, and the datura, solanum, capsicum and tobacco in decorative forms. In the terminology of the druggist there is found within this family the very important forms belladonna, henbane and stramonium, all yielding alkaloids and readily amenable to chemical methods of assay. These three genera, in addition to others from different plant families, are being used in the above-mentioned experiments. Chemical and biological methods are being used in checking and following the progress of the work. It is hoped that correlations may be found to exist between high potency and certain morphological characters. This would eliminate, in part at least,

the chemical and physiological assays, which are expensive, and somewhat long. Following is a brief discussion of what is being done with some of the forms under investigation.

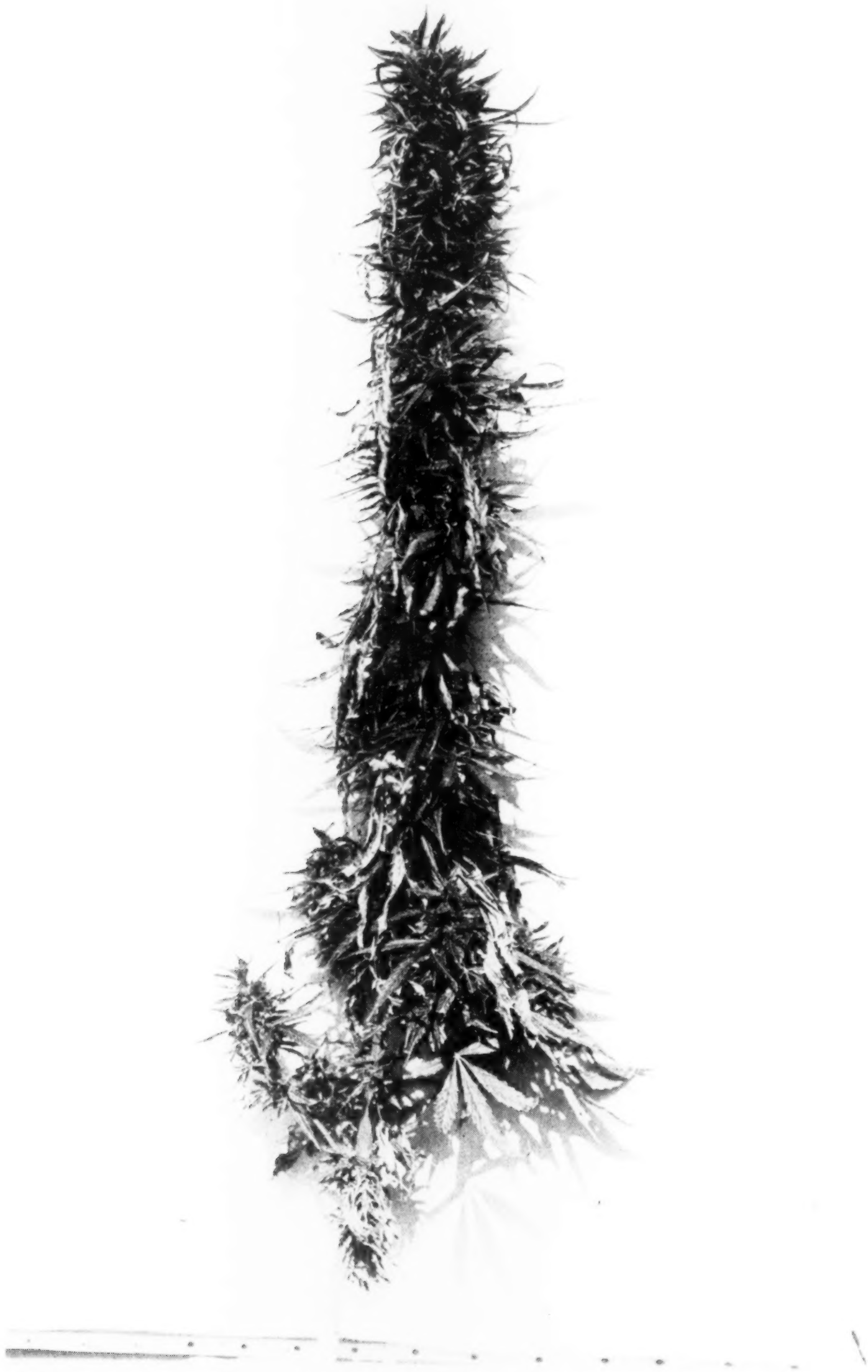
Both the leaves and roots of belladonna (*Atropa belladonna*) are used. They must yield, respectively, 0.30 per cent. and 0.45 per cent. of alkaloids. During the past three years, six per cent. of all shipments of the leaf examined were below standard. The variation in percentage of alkaloids for the same period of time was from 0.23 to 0.62 per cent., average 0.43 per cent. Of the shipments of root examined, 28 per cent. were below standard, with a variation of from 0.17 to 0.66 per cent., average 0.48 per cent. No attempts have been made to breed belladonna for a high yield of alkaloids, a possibility which is suggested by the range of variations as indicated above. That the belladonna plant does possess a higher yielding power than average figures would suggest, is shown by a yield of 0.9 per cent. of alkaloids which was obtained upon a plot fertilized with commercial acid phosphate. Such a high yielding power as this would of course not be transmitted by these plants to their offspring. It is only mentioned to indicate the possibilities of locating high yielding plants by testing leaves from selected individuals.

A number of such selections have been made. Individual plants were selected, numbered and inbred. Samples of leaves were taken from these individuals upon which to determine the alkaloidal yield. These selected plants were also propagated vegetatively, and the resulting plants are being grown in the greenhouse. Some of them are growing in pots in the original soil in which the parent plants were grown, while others are growing in various mixtures of widely differing soils. In this manner it is hoped that some information may be gained upon the behavior of the alkaloids with respect to inheritance, effects of soils, variation in yield from plants grown from open pollinated and close fertilized seeds, and from those propagated by cuttings. The selected plants so far tested indicate a variation in yield of from 0.55 per cent. to 0.87 per cent. of alkaloids. The progeny of these plants of known yield will be tested in a similar manner.

The external characters of the belladonna plant are extremely uniform, with the exception of total yield of leaves and roots per plant. This exception will be taken advantage of in selecting for

SELECTED FORM OF INDIAN HEMP.

Drug-producing plants show a wide range of variation, and this photograph shows one extreme of the forms of *Cannabis sativa* or Indian Hemp which, aside from producing seed for canaries, furnishes a powerful narcotic drug, used like opium in nearly all parts of the orient, but particularly among Arab peoples and in India. (Fig. 8.)



ANOTHER FORM OF INDIAN HEMP.

This photograph shows the other extreme of the forms in which *Cannabis sativa* is found. Not only is the type of plant different but the character of inflorescence is changed. It is believed that these changes in form may be used as clues to detect changes in the chemical properties of the various drug-producting plants. (Fig. 9.)

increased production of these products. Individuals vary in amount of dry root produced from 139 grams to 203 grams. It has been stated that the percentage of alkaloids in the roots of this plant increases markedly after the first year and reaches a maximum at the end of the third year's growth. Belladonna is not perfectly hardy throughout the central United States, and more hardy strains must be developed before the above condition can be observed to advantage. Sixteen hundred plants are now being tested in the vicinity of Indianapolis for relative hardiness.

Henbane is a pharmacopeial drug, supposed to consist of the dried leaves and flowering tops of *Hyoscyamus niger* collected from plants of the second year's growth. This product must yield not less than 0.08 per cent. of alkaloids. Records covering one hundred and two inspections of this drug, purchased in the drug markets of the United States, show but thirteen per cent. with a yield of alkaloids equal to or above this requirement. The remaining eighty-seven per cent. vary from 0.018 per cent. to 0.075 per cent. From a botanical point of view, this drug is also far from uniform. Many samples and shipments contain seeds which germinate readily and, when grown to maturity, furnish a means of accurately identifying the original material. A number of shipments have been checked in this manner during the past two years, and annual plants have been found in nearly all cases. The official requirements state definitely that the drug must be collected from plants of the second year's growth. However, without some provision for controlling this collection, little can be done toward obtaining an official product in this respect. Certainly the above conditions of alkaloidal yield and botanical origin of this drug are strongly suggestive of the necessity and desirability of subjecting the genus to a thorough and rigid investigation. This investigation should have to do with the isolation and cultivation of the annual and biennial forms, as well as all species and varieties of these. Individual plants should be selected for breeding purposes, and tested for yielding properties in the same manner as described for belladonna.

Stramonium has been taken up in a similar manner, and the work on *Datura stramonium* and *Datura tatula*, two common forms, has now been carried through the second year. Selections of *D. tatula* gave a variation of alkaloidal percentage of from 0.47 to 0.65. The plants yielding these extremes produced offspring as follows:

Of ten individuals from the plant yielding 0.47 per cent. alkaloids, a range of from 0.44 per cent. to 0.57 per cent. was obtained, the average for the ten being 0.51 per cent. Of the same number of individuals from the plant yielding 0.65 per cent., a range of from 0.43 per cent. to 0.77 per cent. was obtained, the average in this case being 0.65 per cent. In the first group seven of the ten plants tested exceeded the parent in alkaloidal yield, while in the second, only five exceeded the parent. It is of interest to note that the lowest limit (0.43 per cent) was found in the progeny of the high-yielding plant (0.65 per cent), the lowest limit in that of the low-yielding plant (0.47 per cent.) being 0.44 per cent. The most promising feature of this experiment in its present stage is the greater average yield obtained over that from wild plants from the same locality. A mixed sample of leaves from uncultivated plants of *Datura tatula* gave a yield of only 0.35 per cent. in comparison with average yields of 0.51 and 0.65 per cent. from selected plants. These latter figures might also be compared with the average yield of commercial shipments of stramonium as noted for three years, which is 0.34 per cent. The analysis of the *Datura stramonium* selections of the past year, which were performed in the same manner as those of *D. tatula*, have not been completed. The parent plants, however, from which these selections were made, gave yields of 0.46 per cent. and 0.55 per cent. respectively, which figures represent the low and high limits obtained from a number of individuals.

Two other varieties of stramonium not common to this country were grown and tested. These were *Datura humulis flava*, bearing large, beautiful, double yellow flowers of peculiar fragrance, and *Datura ferox*, a form very closely resembling *D. tatula*, but having a more vigorous and robust habit. Both of these forms were obtained from Germany. The first contained, in a mixed sample, 0.42 per cent. of alkaloids, and individual selections of the second gave a variation of from 0.53 per cent. to 0.70 per cent of alkaloids.

It is to be regretted that none of the first plants selected for testing were close fertilized. During the past year, all selected plants were inbred, and only these will be used in continuing the work. Twenty crosses were made among the three species, *stramonium*, *tatula* and *ferox*. The effects of these crosses upon alkaloidal yield, as well as upon visible characters, will be noted during the next growing season.

Digitalis, the common garden foxglove, has been chosen as another medicinal plant upon which to test the effects of breeding. It is also an official drug, and must consist of leaves from the second-year plant of *Digitalis purpurea* at the commencement of flowering. This form has been included for experimental purposes on account of its value to the physician and because of a wide variation and much uncertainty in physiological effect. There is also a lack of experimental data upon such questions as the comparative value of the wild and cultivated plant and of the many different species and varieties, of the effects of cultivation upon medicinal value, time of collection, methods of curing, packing and storing and of the influence of various ecological factors.

In the study of the group, it is not only desirable to compare the many species and varieties medicinally, but also to determine their relative yield of crude material, ease of culture, hardiness, flowering period and the effects of hybridization upon these respective characters.

Thirty-two forms, consisting of both species and varieties, are under observation. These have been started from seed purchased of commercial seedsmen. The most prominent trade catalogues from this country, England, Germany, and Japan have been examined, and all forms of the foxglove listed in them have been obtained. Some of these were started in the greenhouse as early as December, in an effort to bring as many of them as possible into flower the first year.

The early flowering individuals are being utilized for breeding purposes, in the hope of obtaining either annuals or biennials of a higher and more uniform quality. Mixed samples of leaves collected from plants of the first year's growth of all varieties studied have been biologically tested. Many of the varieties test as high as a good commercial drug, and some of them even exceed this article in relative strength, as indicated by the above method. Others have proven extremely inactive, the poorest, as indicated by the physiological tests, being only one-sixth as active as the best.

In addition to biological tests, the external characters must also be closely observed. Upon a basis of leaf forms, the genus is easily divided into two groups. One of these is characterized by broad, rough leaves and includes such varieties as *purpurea*, *monstrosa*, *alba*, *gloxinioides* and others. They vary greatly in physical char-

acters, and apparently hybridize with considerable ease. The other group is characterized by narrow, smooth leaves and includes such forms as *lanata, ambigua, grandiflora, sibirica, canariensis* and others. The members of this group vary little in external characters, and hybridize with considerable difficulty.

The foregoing is only expected to serve as a suggestion to those who may be interested in, or have the opportunity to observe or investigate, medicinal plants. Much good will have resulted if better crude drugs of vegetable origin can be produced from the wild forms, by an application of the rapidly advancing views of the practical breeder. It is only just that the demands upon the plant kingdom should be exhausting, and such will not be the case until medicinal plants are included in the category of the plant breeder.

Research and Practice

There can not, I think, be any doubt that both the practical breeder and the student of heredity would profit much by a knowledge of the methods employed and the results obtained by the other. It is a question which of the two would gain most: the man of science by the knowledge of the facts relating both to the successes and failures of the breeder; or the breeder by an acquaintance with the principles elucidated and the precision of the records kept and the methods employed by the man of science. It is desirable that the student of heredity should, for the sake of his science, become interested in breeding. It is desirable that the breeder should, for the sake of his art, become interested in heredity. And, in general, it is desirable that each should recognize that he has much to learn from the other; for though, as we have seen, the objects of their work are different, the problem which they are both investigating is the same.—A. D. Darbishire: Breeding and the Mendelian Discovery (1911).

A Eugenic Conscience

A far more effective means of restricting bad germplasm than placing elaborate marriage laws upon our statute-books is to educate public sentiment and to foster a public eugenic conscience, in the absence of which the safeguards of the law must forever be largely without avail.—H. E. Walter: "Genetics."

COLOR IN SHORTHORN CATTLE

Sources of Error in Computation from Matings Very Large—Roan Perhaps a Simple Dominant Pattern Depending on Arrangement of Red and White Hairs

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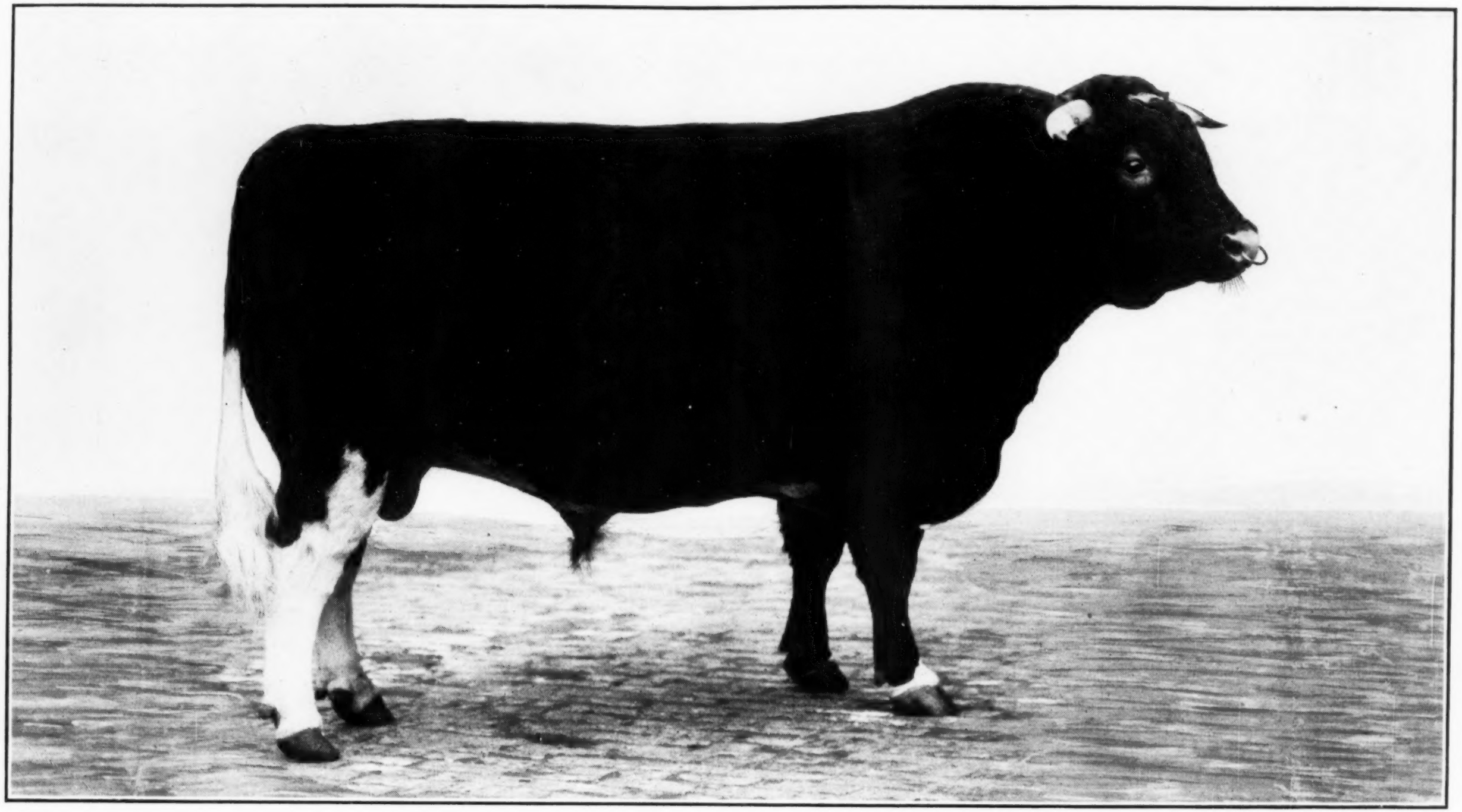
The colors of Shorthorn cattle have been a familiar subject of investigation for many years. The breed differs from most cattle breeds in having a diversity of colors rather than a single one, reds, whites, red-and-whites, and roans being the somatic classes. Bateson, Wilson and others have made the suggestion that roan is the heterozygous condition of red and white in crosses and have postulated a simple mono-hybrid ratio to cover the results. Wilson has supported this by the presentation of data under several titles, but the fact that such a hypothesis is only approximate was pointed out by Barrington and Pearson in a rather extended study.

Laughlin in 1910-1911 built up a hypothesis that accounted for the objections made by the biometricians, but to many it has seemed that the explanation, while suggestive, is somewhat more involved than the facts demand. Laughlin's study was largely based on pedigree records, a source that normally contains five per cent. of error and for a period of a few years in Shorthorns (due to fashion), shows as high as thirty-five per cent. The writer made an error in supplying data to Mr. Laughlin, which was not discovered until December, 1912, but for which an apology is certainly merited. On page 709 of his paper, in the course of a tabulation it appears that 136 roans were produced from "red by red and white matings." This should have read "red by white," the words "red and" being redundant. Also there should have appeared in the tabulation 145 roans from white roan matings. These errors resulted from trusting a student in whom confidence ought to have been justified, but unfortunately the horse was stolen nearly two years before the stable was locked.

A discussion of the sources of error in the Shorthorn records is of importance. The commonest method is in the recording of reds, red-and-whites, and very dark roans or spotted dark roans. For a period of over one hundred years, red was the fashionable color of the breed. This lasted until the eighties in the open market, when the growing popularity of Scotch roans served to set it aside, but the red "craze" still persists with hundreds of small breeders. In proportion as reds were popular then and roans now, one finds that whites and red-and-whites were in disfavor.

This had two effects. It caused the recording of many red-and-whites or dark roans as reds, in order to facilitate their sale, as is witnessed by the illustration in this article of the red and white bull, Diamond Goods 333014, who was the champion Shorthorn bull at the 1912 Iowa State Fair and the first prize aged bull at the International Live Stock Show at Chicago the same season. He is recorded as a red in the fair catalogs and the herd book, yet, as the illustration shows, he is obviously red-and-white. This lack of color popularity appeared also in the whites and prevented the registering of a large number, since there was little demand for them. In fact, it was a common belief of breeders that the only value in a white bull lay in his ability to neutralize red-and-white cows in the herd by siring roan calves from them. It is readily seen that the percentage of reds is markedly increased by the addition of many that are red with white underlines or with small spots on the body, or that are very dark roans easily able to pass as solid colored. It also affected the percentage of red-and-whites and whites. Witness the figures the writer is presenting (3392 red, 777 red-and-white, 3780 roan and 755 white) in this study. If normal frequencies obtained, almost any breeder not too patriotic would admit that the red and red-and-white figures should be reversed. This latter condition alone, in relation to the total number, permits forty per cent. error, so that the writer feels thirty-five per cent. is not a radical estimate.

As has been previously noted, it is usually considered that roan is heterozygous between red and white, comparable to the "blue" of the Andalusian fowl. Laughlin, however, departs from this and hypothecates, with excepted areas, two mosaically alternating sets of hairs over the body, one group possessing dominant white, the other albinic. It is the writer's purpose to consider roan a mosaic also, but to make it a simple dominant pattern consisting of an



WHY LAWS OF HEREDITY SOMETIMES FAIL.

Application of Mendel's law to the inheritance of coat color in Shorthorn cattle is much complicated by the fact that, until recently, red has been the only stylish color in this breed, and owners consequently labeled every animal "red" if it even remotely approached such a condition, thereby including many roans and red-and-whites. Diamond Goods 333014 (shown above) is recorded as red, both in the fair catalogs and herd book, although he is obviously red-and-white, which makes a good deal of difference in the transmission of color to his progeny. (Fig. 10.)

irregular arrangement of red and white hairs. It varies in amount of white within itself, hinting at the fact that it is probably not a single unit but complex. It is not necessary to go into this here as, roughly speaking, roans are readily recognized, although probably two per cent. of errors do occur. It is complicated frequently by the fact that spotting patterns appear in connection with it, thus causing the appearance of roan and white or spotted roans. These are always disregarded in recording, however, the term roan being applied to all conditions.

When a homozygous red self-colored animal (RRpp) is crossed on a homozygous white (rrPP) the offspring should be roan (RrPp). (P equals roan pattern; R equals red pigment.) On breeding these F_1 individuals, the F_2 should show nine roan, three red and four white. This is exactly what the writer has found in records from personally known animals in the Iowa state college herd, which from their breeding must be heterozygous for both factors. By breeding is meant both pedigree and breeding performance. The figures are thirty-six roan, eleven red and seventeen white. Laughlin calls attention to the fact that there is an excess of roans, 62.5 per cent., where simpler theories call for 50 per cent., and suggests three classes of homozygous roans to account for it. The writer's suggestion would call for 56¼ per cent., and the difference between that and Laughlin's 62.5 per cent. may be readily explained by the few whites recorded which thus raise the percentage of other colors.

There are figures available on roans that are apparently RRPp and RrPP. Roans of the former class bred *inter se* give ten roans and four reds, while roans of the latter class give eight roans and two whites. When the two classes are crossed, only roans, eight in number, result. This would agree with the expectation. When animals of either class are mated to the individuals of the RrPp class, the expected results appear although numbers are small, RRPp to RrPp gives three roans and one red, while RrPP to RrPp gives four roans and two whites. In these cases just preceding the term reds includes red-and-white individuals, or all except the roans and whites.

It has already been mentioned that roan and red are both complicated by spotting patterns. It may be well to digress here briefly, in order to discuss these spots. In general, it may be said that the

greatest degree of pigmentation may be found on the head and neck, over the shoulders, back, sides and hind quarters, while the lightest degree is found in the flanks, on the belly, brisket and switch and in the inguinal region. This condition may be traced in the photograph of the roan bull. If spreading of the light area takes place, the different areas of the animal yield in the following order: Flanks, withers, sides and back, rump, thighs, shoulders, neck and head. These general tendencies probably belong to a separate category from those patterns involved in the white markings on legs, face, front, or distinct body spots. That these patterns are separate is readily demonstrated by observing their segregations in red-and-white animals. With a few exceptions, these patterns are probably no more constant than the spotting pattern of laboratory mice, the variegation of maize or the checking of pigeons. Roan is entirely separate from these types of patterns, because it behaves as a distinct unit segregating away from it, although it is possible that the others may not show except in the presence of roan. However, an occasional uniform roan is found. They are usually dark roans with no tendency to the appearance of white spotting. Roan combined with the different types of red-and-whites gives as many kinds of light roan.

The advantages of assuming the red, roan, white inheritance as a di-hybrid phenomenon are manifold. It permits the production of whites from heterozygous self or spotted reds, a point which has proven a stumbling block for many students. In fact, it would permit the formation of all four classes of colors from every mating except the following: Red to red, which can produce all but roan; red to red-and-white, which can produce all but roan; red-and-white to red-and-white, which can produce all but roan, and white to white, which can produce only white.

This brings to point the discrepancies of the scheme with the table. There are a sensible number of red to reds or red-and-whites, and red-and-whites to red-and-whites that according to the pedigrees have produced roan offspring, viz.—102 out of 1851 in the subjoined table or nearly six per cent. Since in data on living or known animals the writer has never found such a condition, it was deemed advisable to investigate these 102. At present only the thirty-four presented by Robert Bruce have been investigated. Of these thirty-four, the writer was able to discover twenty-seven in-

dividuals. Submitting them to a herdsman friend who was thoroughly familiar with Cruickshank's animals, it was learned that nineteen of these twenty-seven were from red by very dark roan parents and the other eight were disputably roans or red-and-whites. The unpopularity of red-and-whites might easily cause the recording of some as roans. This investigation coupled with the confirmation of living animals makes it seem possible that these are all errors. It is extremely arbitrary to say this, but the uniform success of the first investigation makes it possible.

The other discrepancy of this theory comes in the white to white mating. Fortunately the numbers are small here, 4 reds and 8 roans being the stumbling blocks. In one instance the writer has learned that the dam of a red in question is light roan and not white. This would explain that case, while the chances of cows being served by bulls other than those named in the pedigree, the number of fraudulent entries and the sources of error already stated may account for the rest. Also the possibilities of whites of different sorts existing comparable to Emerson's beans would account for this. A white of the type of the wild park cattle of England mated to a normal Shorthorn white produced a blue gray in the cattle breeding experiments at Iowa State College. If merely red pigment were carried instead of black, the preceding colors might result.

A large number of pedigrees have been studied and the papers named at the close have been drawn upon for their records. It is undoubtedly very dogmatic to throw by the boards all evidence that does not suit, but the records of living animals and the confirmatory result of a partial investigation, make it seem possible that these speculations are founded on substantial fact.

RESULTS OF MATING.

	Red	Red & W.	Roan	White
R x R	1180	115	68	16
R x R & W	223	119	23	22
R x Roan	1431	217	1212	13
R x W	6	9	667	17
Roan x R & W	62	53	124	2
Roan x Roan	459	205	1275	471
Roan x W	3	5	168	72
R & W x R & W	21	52	11	1
R & W x W	3	2	224	1
W x W	4	0	8	141
	3392	777	3780	755

LITERATURE CITED.

"Transmission of Color in Shorthorns," *Breeders' Gazette* 1909—By James Wilson.

"Breeding for Color in Shorthorns," *Breeders' Gazette* 1909—By Robert Bruce.

"On the Inheritance of Coat Colour in Cattle"—1912. Laughlin—*American Naturalist*, Vol. 45 and 46.

"The Inheritance of Color in the Seeds of the Common Bean, *Phascolus vulgaris*." R. A. Emerson, 22nd Annual Report, Nebr. Exp. Sta.

The Progress of Eugenics

Since the point of attack in human heredity must be largely statistical, it is of the first importance to collect more facts. Our actual knowledge is a confused mass of tradition and opinion, much of which rests upon questionable foundations. The great present need is to learn more facts; to sift the truth from error in what is already known; and to reduce all these data to workable scientific form. Much progress is being made in this direction, owing to the impetus given by the revival of Mendel's illuminating work, but as yet the science of eugenics is in its infancy.

The most systematic and effective attempt in this country to collect reliable data concerning heredity in man has been initiated by the Eugenics Section of the American Breeders Association, under the secretaryship of Dr. C. B. Davenport. In 1910 the Eugenics Record Office, with a staff of expert field and office workers and an adequate equipment of fire-proof vaults, etc., for the preservation of records, was opened at Cold Spring Harbor, Long Island, New York, with Mr. H. H. Laughlin as superintendent. "The main work of this office is investigation into the laws of inheritance of traits in human beings and their application to eugenics. It proffers its services free of charge to persons seeking advice as to the consequences of proposed marriage matings. In a word, it is devoted to the science and practice of eugenics."—Genetics, p. 246, by Herbert Eugene Walter, assistant professor of biology, Brown University. New York, the Macmillan company, 1913.

Genetics and Social Service

Any training for social service such as is now becoming frequent is of little or no use unless the principles of heredity are taught and taken into account.—W. C. D. and C. D. Whetham: Heredity and Society.

DISSEMINATION OF NEW TROPICAL PLANTS

Rich Harvest Awaits Concerted Effort Among States in Warmer Climates—New Plants to be Secured and Better Varieties of Old Ones to be Tried

C. F. BAKER

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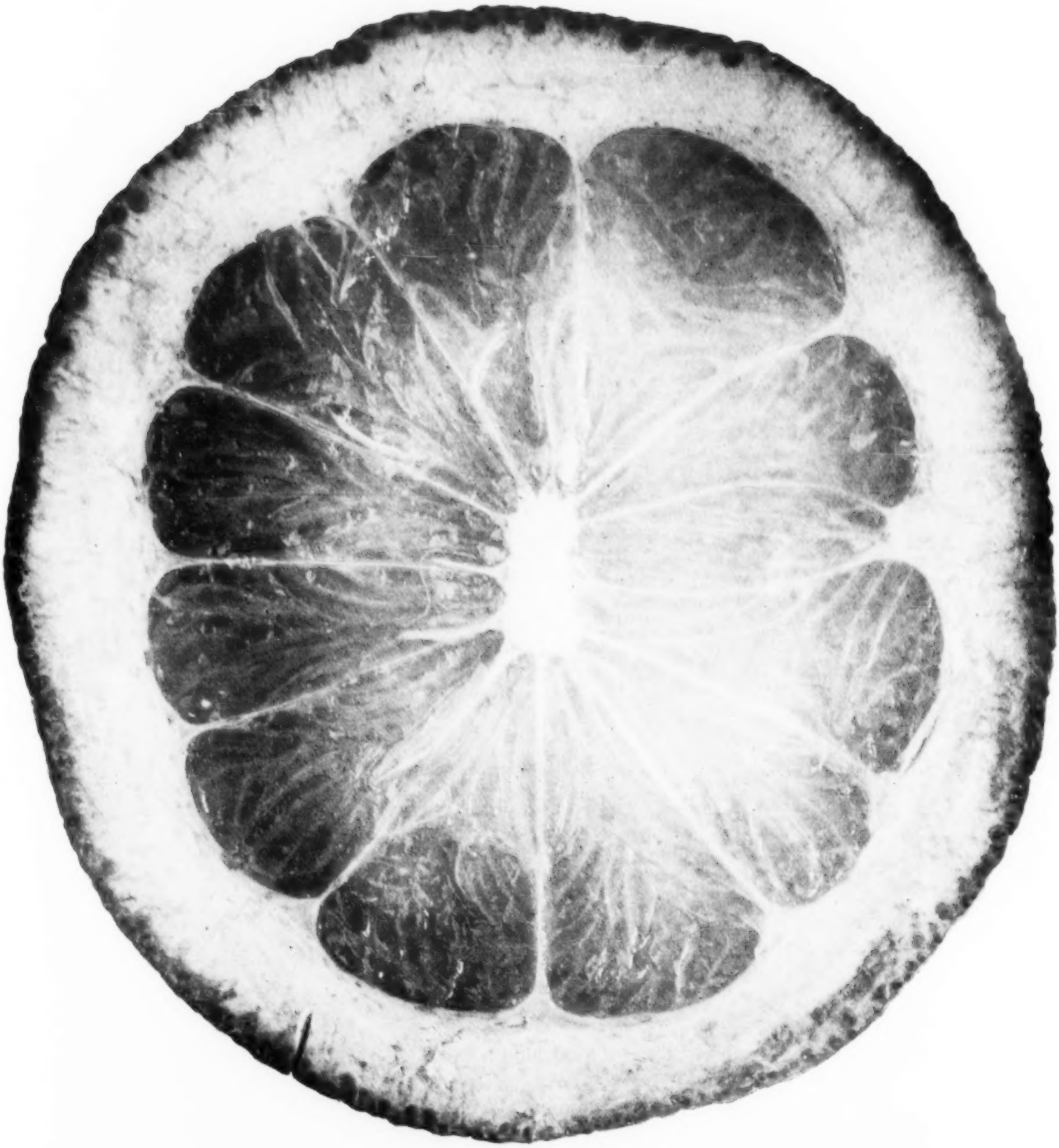
One of the most spectacular features in the agriculture of the last century was the transplantation from great distances, and sudden change from scattered and wild condition to fine and immensely valuable cultivated plantations, of Cinchona (quinine), and Hevea (Para rubber), and other important plants. Cinchona was snatched out of the wilds of Peru, and Hevea taken from the valley of the Amazon, to add to the riches of Ceylon, Java, and the Malay countries. The credit for this great work belongs to Englishmen, and in part to the Kew Gardens. Indeed, of all agencies, the English Botanic Gardens have perhaps exercised the greatest leavening influence on the tropical agriculture of the world. Such names as Willis, Fawcett, Ridley, and Wright are names to conjure with in connection with the subject of tropical agronomy. The most extensive work in the originating and disseminating of new canes, of experimentation with cacao and tea, and the introduction into English colonies of numerous valuable minor crops, are all due to the same enterprising sources. The story of these efforts and their results, read in the existing assets of today, sounds like a fairy tale, the first introductions involving hazardous long-distance sendings of a few living plants—pioneers destined to found great industries in far-away lands. The stories of discoveries of gold fields in remote corners of earth, by chance surface indications, can offer nothing more romantic or of greater moment to the world.

Very characteristic of early tropical agriculture was the extreme localization of crops. There was only one circumscribed region for good tobacco, another for spices, another for rubber, another for

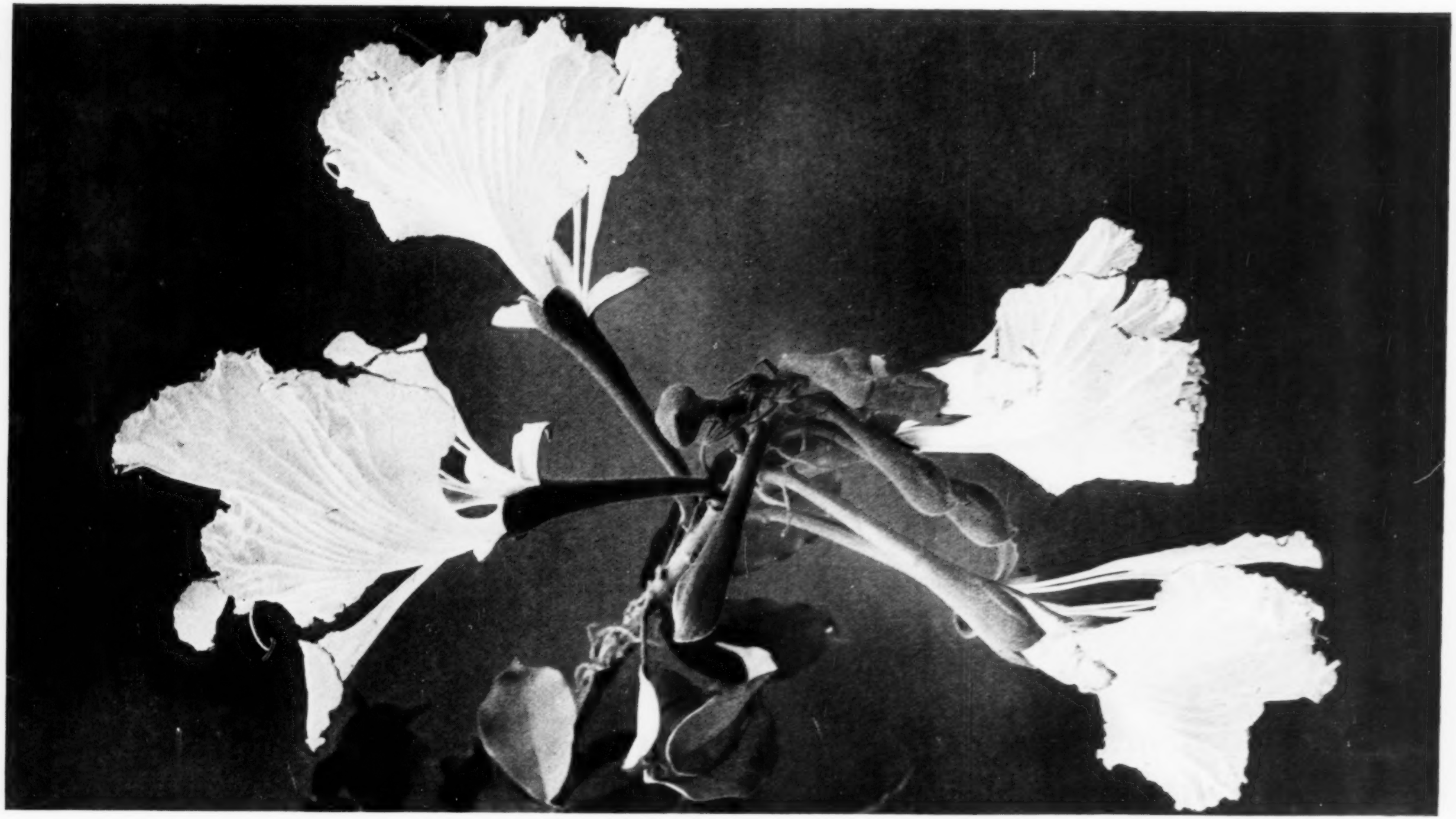


SIAMESE SEEDLESS POMELO.

The pomelos (grapefruit) of Siam have been famous for many years, and repeated attempts have been made to secure them for introduction to other countries, but their inaccessibility has usually frustrated these attempts. They are now established in the Philippines, however, where they are said by experts to be fully as good as their reputation would indicate. They are probably not suited for growth in the United States, because of their tenderness. It is said that they are fond of salt water, and are usually grown where they are occasionally inundated by the sea; failing this, the cultivator places salt on the ground about their trunks. According to one report, they are seedless only in the dry season, and frequently develop seeds during the rainy months. They are generally considered, however, to be the most nearly seedless of any known polelo. (Plate 11.)

coffee, another for cacao, whereas, as has since been so conclusively proven, there are numerous other regions equally well adapted to producing these crops. A broadcast dissemination of the more important tropical crops was one of the great agricultural features of the last century. In later years an even more interesting development has been taking place—the gradual adaptation and modification of certain tropical plants to suit greater extremes of climate, the crowding of them farther and farther into the borders of the temperate regions, close up against, or over the frost line, where greater margins of profit may often be realized from them than in their native climes.

While no other tropical cultures may ever exceed in extent those of rice, cane, corn, tobacco, coconut, coffee, tea, and cacao, it is well recognized that great numbers of as yet little-known tropical plants are gradually coming into profitable culture. Numerous important tropical products are yet harvested only from wild plants. The masses of people of the temperate regions are developing tastes, uses, and needs for numerous tropical products formerly little known and practically unexploited. The market for tropical ornamentals in temperate regions, and even in parts of the tropics, has grown enormously in the past few years. With most of these things, extreme localization is again the rule. One mountain, one valley, one island, or one limited district, may possess plants sought by the whole world. Some of the finest things long in horticulture are extraordinarily local in their original distribution. Every exploration of new or little-known regions furnishes a host of new horticultural and agricultural possibilities to the "prophetic eye." Some such regions have yielded full-fledged horticultural and agricultural prizes, equaling or even bettering some of our most highly improved economics of long standing, as, for example, fine sugar cane out of Papua, and pomelos out of South China and Siam. Novelties of great promise still appear in ever-increasing numbers. Native and practically wild fruits of far greater promise than were the progenitors of any of our temperate-region fruits, occur in great numbers throughout the tropics of the world. Magnificent ornamentals in great variety are still unknown to horticulture. What a field for exploration, investigation, and future experimentation it all presents! The gardens so common about dwellings throughout the tropics are notoriously poor in variety of ornamen-



FLOWERS OF CAMOENSIA MAXIMA.

This vine, discovered by Welwitsch in tropical Africa, has probably the largest flowers of any of the Leguminosae. Those grown in the United States (under glass) have been as long as eight inches; pure white with an edging of gold, and delightfully scented. Sometimes a dozen of these flowers are borne in a single raceme. Cultivation of this magnificent climber is at present confined to the larger botanic gardens; it first flowered under cultivation in Trinidad, in 1882. It should be widely spread throughout the tropics. (Plate 12.)

tals. One gets thoroughly tired of seeing all these little gardens planted with the same old pantropical ornamentals like *Hibiscus rosa-sinensis*, *Caesalpinia pulcherrima*, the Codiaeums, Dracaenas, and Aralias. One gets a very different impression when he visits a great tropical Botanic Garden—say at Singapore—and sees there grand and marvellous ornamentals, which are all the more noteworthy because not found widely distributed. Once seeing them, collectors or dealers would gladly pay almost anything within reason to obtain them. Wonderful scandent climbers are there, like *Hesea lobbiana*, *Bignonia magnifica*, *Clerodendron thomsonae* and *Camoensia maxima* (a legume with colossal flowers 9–12 inches long). It is incomprehensible why a shrub with such magnificent flowers as has *Randia stanleyana*, or a vine so incomparably beautiful as Beaumontia, should not have been more widely distributed—their culture is not difficult. Even the Philippines are rich in superb native ornamentals of the highest possible order of excellence, that are not only absolutely unknown to horticulture, but only very recently made known to science. *Paramigyna longepedunculata* is a splendid rutaceous vine, provided with masses of rich cream-colored, orange-scented flowers. *Derris philippinensis* is a vine producing a display only exceeded in beauty and richness by the wistarias of Japan. Other woody vines of extraordinary beauty of flower or foliage are furnished by the genera Symphorema, Strongylodon, and Bauhinia. Few ornamental trees are grown exceeding in beauty *Milletia foxworthyi*, *Wormia luzonensis*, and Petraeovitex (*fide* Dr. Foxworthy).

When one passes to the fruits it may be said that many of the finest known to the tropics have never been in anything like cultivation—some not even in a state of semi-domestication. The mangosteen and durian of the East, and the biriba and cupuassu of the Amazon, are perhaps the regal fruits of the tropics—all exceedingly local in distribution. A promising new fruit now comes from the long-settled island of Mindanao, in *Mangifera verticillata*. But these are merely examples. Resident horticulturists in many parts of the tropics tell the same story of their own regions. Some of the richest and most interesting portions of the tropics are still almost wholly untapped, so far as horticultural possibilities go. The larger Malayan islands, Central Africa, and the interior Amazonian region are rich beyond the wildest dreams of temperate region horti-

culturists. The really curious thing is, that no concerted or systematic effort is being made to exploit all these riches. Their discovery and introduction is usually due to the individual enterprise and effort of some devoted enthusiast, and so the work proceeds at a snail's pace.

The above discussion refers principally to distinct species of plants yet to be brought into horticulture. No less interesting, and of far greater immediate moment, is the matter of rare and local varieties of species long known and cultivated. Reference has been made to the finding of a new and superb sugar cane in Papua. Not many years ago but few coffees were known, whereas now many are being tried out, some of greater resistance to the destructive rust than any formerly known. Certain varieties of cacao will thrive under conditions that others will not tolerate. New forms of Cinchona are replacing those first planted. Vast numbers of distinct varieties of bananas are known in the tropics—very many of the best confined to certain remote localities. No comprehensive work on banana culture has ever been attempted, though bananas are a tropical staple, the work never having progressed beyond local collections. The same is true of upland rices, of sweet potatoes, of yams, of legumes, and many other crops.

The fruits of the tropics, as well as cacao, rubber, and other important trees and shrubs, have been propagated almost wholly from seed. This has produced a most extraordinary and interesting condition from the horticultural point of view. It out-Burbanks in richness of opportunity anything even Burbank ever dreamed of. For instance, in the Philippines, one of our common fruits, the lanson (*Lansium domesticum*), varies widely in character and value, as do also the sapodillo (chico), the santol, and other fruits. Frequently trees are found giving fruit of exceptional size, flavor, or of exceptional yield. Some are found habitually fruiting off season, and hence of exceptional value. Absolutely nothing comprehensive has ever been done to seek and isolate these better forms, propagate them, and disseminate them. The mammey of the West Indies (*Mammea americana*) is sometimes described as a fruit of only medium size, hard, and with large seeds, and the flesh resembling that of the carrot. But specimens can be found bearing fruits the size of a child's head, and when ripe, with rich, soft, and most palatable aromatic flesh, that can be readily eaten out with a spoon.

What is the use of wasting time in culture of any but these best forms? One does not really know the papaya unless one has eaten the best form of the Dapitan of Zamboanga, or some of the better varieties of Central America. One does not know the sapodilla until he has tried a variety some three inches in diameter, with melting flesh, and a minimum of gum. On hearing some aspersions cast upon the caimite (*Chrysophyllum cainito*), a valuable and delicious fruit at its best, a Cuban was heard to remark, "There are caimites, *and there are caimites!*" A similar remark might be made of most tropical fruits. The methods of seed selection, of breeding, and of vegetative propagation have rarely been brought to bear on any of these things. As for systematic search for the better forms now existing, and the rapid building up of really comprehensive experimental plantations of them in tropical Botanic Gardens and Experimental Stations, we have yet a field of highly useful, most remunerative, and intensely interesting work before us.

The tropical Botanic Gardens began collections of all the tropical fruits and economics many years ago. The first seed they obtained was often poor and unselected, representing only one strain, and often an undesirable one at that. In many instances the work has never progressed beyond that first and ineffectual attempt, and in certain instances has led to ill-founded condemnation of certain things for these localities. Yet, as before stated, the Botanic Gardens have accomplished a great work in dissemination, so far as it has gone, but they have a far greater work before them. They keep up continual exchanges of material between themselves, and with private individuals everywhere. But the development of this line of work through this channel alone, as at present operated, can only take advantage of the existing possibilities in centuries of time. There has been no such thing as systematic coöperative work in the search for and rapid dissemination of the better varieties. Yet there can be no comprehensive experimentation, no well-founded work in breeding or selection, without bringing the largest possible percentage of the very best types into experimental plantations together. Out of a large collection of roses taken to Cuba, a large number soon succumbed; a small proportion did fairly well, while a very few were great successes. Large collections of beans, peas, and other crops, taken to the tropics, commonly furnish but very small percentages of really striking and important successes. How

SAPODILLAS GROWN IN FLORIDA.

This is the fruit of *Achras sapota,* a tree found wild throughout Southern Mexico and Central America, where its milky sap is collected, evaporated, and exported as chicle, the basis for chewing gum. The tree is hardy in parts of Florida; its fruit is characterized by a thin, brown skin, inclosing a pale brown, luscious pulp in which large, black, shiny seeds are embedded. Firminger says "A more luscious, cool and agreeable fruit is not to be met with perhaps in any country in the world." If unripe, however, it is so full of gutta-percha and tannin as to be inedible. The wood, although so heavy as to sink in water, is valuable. (Plate 13.)

fundamentally important it is then, as each group is taken up for experimentation, that all possible forms obtainable from any source should be brought into the test together. As it is, we commonly find our stations trying a few from one source this year, some more from another source next year, and so on *ad infinitum,* with indefinite and scarcely comparable results, that frequently lead nowhere. The very thing that may be able to furnish an immediate success, or to furnish the best basis for breeding or selection or acclimatization work, may not come to hand for an indefinite number of years by this haphazard system.

It is not probable that one-half of the possibilities in acclimatization work have yet been sounded. Even after long reiterated opinions that strawberries, raspberries, grapes, plums, and apples could never be grown in the tropics, varieties have been found—as well as even wheat—that do fairly well under these conditions, and must eventually do very well with careful selection and breeding. The discovery of native species of Rubus, Prunus, and Vitis in warm countries greatly increases these possibilities, and fills them with horticultural interest.

Private individuals and government gardens rarely have sufficient funds available to make appreciable headway in any comprehensive effort. But surely the world is enough civilized now, and surely there is sufficient recognition of common interests among the peoples of tropical countries and colonies, for coöperative systematic work to be undertaken, that shall insure the rapid spreading of the horticultural dragnet in every tropical region of earth. The United States Department of Agriculture, with its splendidly effective foreign service, recognizes the tropical work merely as one of its subsidiary interests. Union and coöperation are demonstrated possibilities in the new International Institute of Agriculture in Rome. Tropical countries uniting and subscribing even very modestly for comprehensive field work and distribution to subscribers of abundant material in all required groups, could quickly put into operation an efficient service that would carry forward tropical horticultural and agricultural development by leaps and bounds.

ASSOCIATION MATTERS

The council has prepared a leaflet giving a brief statement of the work of the association. Members who desire to share the advantages of the organization with their friends may obtain copies of this leaflet by writing the secretary.

In response to numerous requests for information, the secretary states that he can furnish indices of volumes two and three of the magazine to any one who wishes to bind them. The index to volume one can not be furnished, as it was never printed.

The Utah Eugenics Society has elected the following officers: President, Mathohniah Thomas, Salt Lake City; first vice-president, J. C. Wheelon, Garland; second vice-president, Dr. Fred Taylor, Provo; secretary-treasurer, Dr. E. G. Titus, Logan; members of council, Mrs. Martha C. Jennings, Professor Jacob Bolin, Salt Lake City; Dr. E. G. Gowans, Ogden. THE AMERICAN BREEDERS MAGAZINE was adopted as the organ of the society.

As the magazine is the means by which the members of the American Breeders' Association are kept in touch with each other, the council will use every effort to see that each member receives the publication regularly. Members must coöperate by keeping the secretary informed of any change of address. If, after this, one fails to receive any copy of the magazine, the secretary will endeavor to supply it without delay, if notified.

In order that the association may keep in touch with the activities of its members, and may be fully informed of all progress made in its field of genetics, members who publish results of their work on this subject are urged to send copies or reprints to the office of the association, where they will be kept on file.

AMERICAN BREEDERS' MAGAZINE

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COLOR IN SHORTHORN CATTLE — *Edward N. Wentworth*

DISSEMINATION OF NEW TROPICAL PLANTS — *C. F. Baker*

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